PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
CL1987PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 03/09853	01.04.2003	01.04.2002
International Patent Classification (IPC) or both national classification and IPC		
C10L1/18		
Applicant		
E.I. DU PONT DE NEMOURS AND COMPANY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
27.10.2003	30.07.2004
Name and mailing address of the international preliminary examining authority:	Authorized Officer
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US 03/09853

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-17 as originally filed

Claims, Numbers

1-23 as originally filed

Drawings, Sheets

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1,22,23
	No:	Claims	2-21
Inventive step (IS)	Yes:	Claims	1,22,23
	No:	Claims	2-21
Industrial applicability (IA)	Yes:	Claims	1-23
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

1. Reference is made to the following documents :

   D1: WO-A-9421753
   D2: US-A-6054611
   D3: US-A-3489795
   D4: ACS Symposium Series 784 (2001), pages 51-63 (XP8029160)

2. Novelty

   2.1 Independent claim 1 of the present application pertains to the production of a mixture comprising levulinic acid esters and formic acid esters by a process comprising the acid catalysed degradation of biomass and subsequent reaction of a mixture of levulinic acid and formic acid produced thereby with an olefin.

   2.2 The document D2 discloses (cf. example 6) a process for the production of levulinic acid esters from biomass by acid catalysed degradation followed by Fischer esterification with an alcohol.

   2.3 Document D3 discloses (cf. example 1) a process for the production of tert-butyl levulinate from levulinic acid and isobutylene.

   2.4 The document D4 discloses (cf. page 53-54) a process for the production of levulinic acid ethyl ester from biomass by acid catalysed degradation in ethanol.

   2.5 The subject-matter of claim 1 and claims 22 and 23 is therefore novel (Article 33(2) PCT).

   2.6 Independent claim 2 of the present application pertains to a composition comprising levulinic acid esters and formic acid esters made by a process comprising the process steps of claim 1.

   However, the subject-matter of product-by-process claim 2 has to be construed to the product as such, obtainable by the process specified. Accordingly, claim 2 effectively pertains to a mixture comprising levulinic acid esters and formic acid esters in which the alcohol moiety of both esters could be derived from an olefin.

Since mixtures comprising ethyl levulinate and ethyl formate are already known from the prior art (e. g. D4, page 53-54, the esterification reaction mixture), the subject-matter of independent claim 2 and dependent claims 3-21 is not novel (Article 33(2) PCT).

3. Inventive Step

3.1 Even if novelty could be established for the subject-matter of product claims 2-21 not inventive step could be acknowledged :

Document D1, which could be considered to represent the most relevant state of the art, teaches (page 1, line 36 to page 2, line 7; page 4, lines 4-5 and the examples) the use of mixtures of levulinic acid esters and formic acid esters having alcohol moieties of 1 to 22 carbon atoms as fuel additives. Mixture of levulinic acid esters and formic acid esters having an alcohol moiety of 2 or more carbon atoms fall within the scope of claim 2 (cf. 2.6 above, the smallest olefin being ethylene).

The skilled person following the teaching of D1 would therefore arrive at the subject-matter of claims 2-21.

3.2 The subject-matter of claim 1 of the present application can be considered as involving an inventive step (Article 33(3) PCT) :

Though the reaction of isolated levulinic acid and isobutene is disclosed in D3, it was not obvious for the skilled person from the teaching of the prior art (D1 to D4) to produce a mixture of levulinic acid esters and formic acids esters from biomass and olefines as proposed in present claim 1.

3.3 The subject-matter of process claims 22 and 23 comprising the process of claim 1 are also considered as involving an inventive step (Article 33(3) PCT).